DAILY ACTIVITY OF JUVENILE JAVAN GIBBON (*Hylobates moloch* AUDEBERT 1798) IN GUNUNG HALIMUN SALAK NATIONAL PARK

AKTIVITAS HARIAN OWA JAWA REMAJA (*Hylobates moloch* AUDEBERT 1798) DI TAMAN NASIONAL GUNUNG HALIMUN SALAK

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ABSTRAK

Owa jawa merupakan salah satu primata endemik Jawa Barat yang rentan terhadap kepunahan. Berkaitan dengan penurunan populasi spesies tersebut perlu segera ditempuh upaya konservasi, yang salah satu aspek pendukungnya adalah informasi tentang aktivitas harian. Tujuan dari penelitian adalah untuk mengetahui aktivitas harian dari owa jawa remaja di Taman Nasional Gunung Halimun Salak (TNGHS). Pengamatan aktivitas harian menggunakan metode *Focal animal sampling*. Pencatatan aktivitas setiap individu owa jawa remaja dari setiap kelompok dilakukan dengan cara continuous *recording*. Rata-rata waktu aktivitas harian owa jawa remaja dari ketiga kelompok tersebut adalah 9 jam 56 menit dengan persentase rata–rata aktivitas harian dari yang tertinggi sampai yang terendah adalah istirahat (36.21%), makan (33.33%), bergerak (23.05%), sosial (4.94%) dan tidak terlihat (2.47%). Terdapat 11 spesies yang dijadikan pakan oleh owa jawa yang terdapat di Cikaniki – Citalahab dan 4 jenis pohon yang digunakan sebagai pohon tidur selama pengamatan berlang-sung. Klasifikasi strata pohon tidur dominan strata A (lebih dari 30 m).

Kata kunci: aktivitas harian, Gunung Halimun Salak National Park, *Hylobates moloch*, owa jawa, populasi.

ABSTRACT

Javan gibbon (*Hylobates moloch*) is one of endemic primates in Java Island, which listed as endangered and facing the high risk of extinction. Conservation efforts need to be taken immediately in regard to the decrease of this species population. One of aspects that support conservation effort is data on daily activity of this species. The aim of this study was to determine the daily activities of Javan gibbon juvenile at Citalahab Forest Gunung Halimun Salak National Park. We used focal sampling method to collect behavioral data and recording the activity of each individual Javan gibbon by continuous recording. Average time the daily activities of the three groups is 9 hours 56 minutes. Percentage of daily activity from the highest to the lowest is the resting (36.21%), feeding (33.33%), moving (23.05%), socializing (4.94%) and undetected (2.47%). Mostly social activities that do by javan gibbon is play with most frequently performed is wrestling. Javan gibbon in Cikaniki – Citalahab used 11 species as food resource. There are four types of trees used as sleeping tree over the research. The dominant tree strata for sleeping tree is strata A (over 30 m).

Keywords: daily activities, Gunung Halimun Salak National Park, *Hylobates moloch*, javan gibbon, population.

INTRODUCTION

Javan gibbon (*Hylobates moloch* Audebert 1798) is one of the endemic primates in West Java and listed as endangered (Andayani *et al*.2008). Javan gibbon is also listed in APPENDIX I CITES (International Convention of Trade Endangered Species of Wild Fauna and Flora) that prohibited trade for this species. In connection with the decline in the population of these species, conservation efforts need to be taken immediately, one of the supporting aspects is information of the daily activity. Daily activities can describe the condition of the Javan gibbon where if there is a change in activity, it can be ascertained that there are internal or external factors that cause these changes (Saroyo et.al 2006). Changes in the proportion of time spent in daily activities and eating ecology are wildlife's first responses to habitat change, damage and fragmentation

(Umapathy & Kumar 2000). Many animals respond to environmental pressures or ecological challenges by creating new behaviors or using existing behaviors in new contexts or innovations (Kummer & Goodall 1985). Age in primates is often associated with social rankings and positively correlated with success in getting food (Cambefort 1981; Goodall 1986; Silk 1987). Young individuals have a higher metabolism and are expected to help with a greater need for innovation. This study addresses juvenile because young individuals are very explorative and more investigative of new objects that are more innovative than adult individuals (Boesch & Boesch 1981).

MATERIALS AND METHODS

Time and location of study

The study was conducted from April - May 2015 in Citalahab Forest in Gunung Halimun Salak National Park, West Java. The research site was located at 106°13' - 106°46' S dan 06°32' - 06°55' E, at altitudes of 500 -2000 asl. The average temperature was 20-30° C with annual rainfall between 4000-6000 mm/year.

Research subject

To facilitate observation activities, a naming system was given for each individual in the group to be observed (Table 1). We observed the behavior of the three study groups on a rotating basis (group A, B and S). The size of group S is greater than that of group A and B, comprises of five individuals, while group B and group A are four individuals. Each group has adjacent home range and the home range size of gibbon was varied among the group (Figure 2). The home range size of group B is greater than that of group S and group A. Group A tends to be more easily observed and has a more tolerant to human presence because group A it is the longest group that has been habituated to the present of human, since 2007 (Dewi 2016). Whilst groups B and S are more sensitive to human presence since booth are just

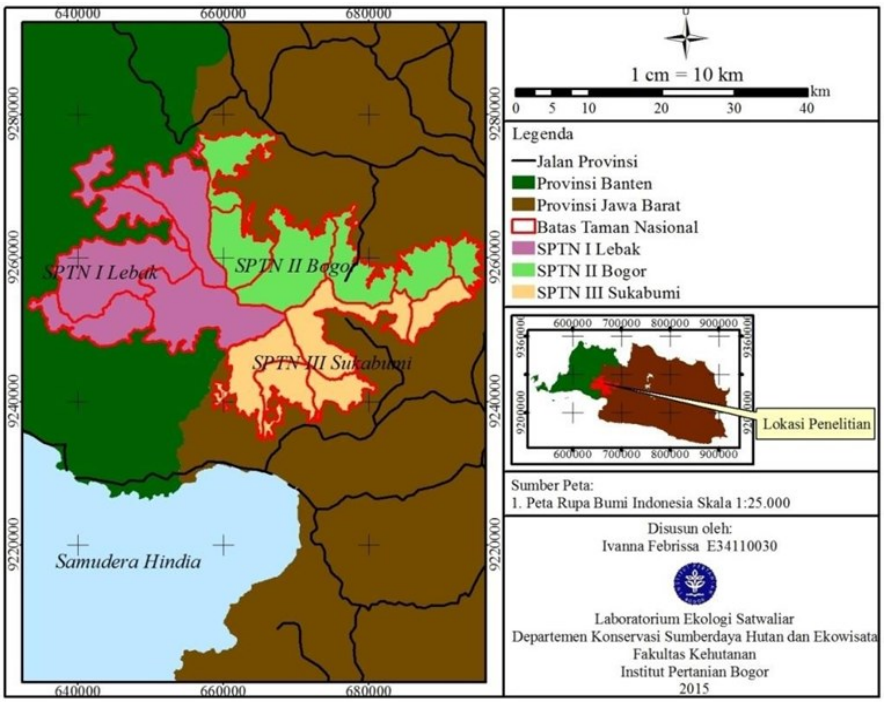
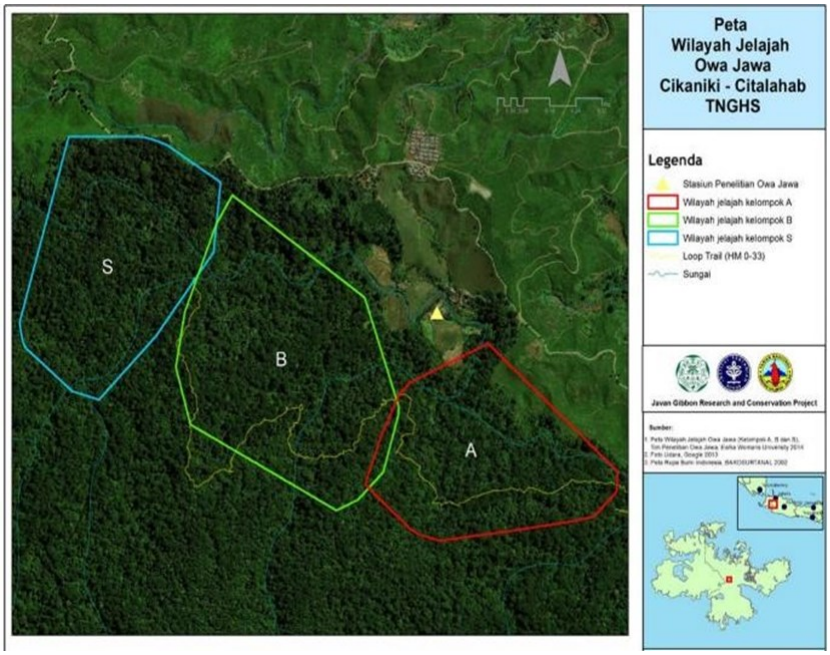


Figure 1. The map of study area of Javan Gibbon in Cikaniki Research Station to Citalahab in Halimun Salak National Park, West Java.



Source : Javan Gibbon Research and Conservation Project (2014)

Figure 2. The home range of Javan Gibbon groups in Cikaniki Research Station to Citalahab in Halimun Salak National Park, West Java.

been habituated from 2012.

Data collection and analyses

Only the young Javan gibbon behaviors of each group were observed in this study, i.e feeding, moving, resting and socializing using the Focal Sampling method (Altman 1974 in Kartikasari 1986). To collect the behavioral data, we used scan sampling method with a 15 minutes interval while observations of playing, grooming and vocalization were carried out with a time interval of 1 minute. The recording of the activities of each Javan gibbon individual was carried out by continuous recording the activities that occurred both the frequency and duration of these activities. Observations were carried out every day for 12 days when the Javan gibbons started their activities in the morning at 05.30 - 06.25 until afternoon at 16.00 - 17.25 with a total time of observation for 3.580 minutes and 2 repetitions for each individual. Time allocation of data collection is

Table 1. The size of the Javan gibbon group was observed.

No	Group	Size	Name	Sex and Gender
1	A	4	Aris	Adult Male
			Ayu	Adult Female
			Amore[a]	Juvenile Male
			Awan	Infant
2	B	4	Kumis	Adult Male
			Keti	Adult Female
			Kimkim[a]	Juvenile Male
			Komeng	Infant
3	S	5	Sahri	Adult Male
			Surti	Adult Female
			Sendi	Sub Adult
			Salwa[a]	Juvenile Female
			Sanha	Infant

[a]Research Subject

carried out alternately. We analyzed the data using descriptive and qualitative approach. Descriptively to describe all types of Javan gibbon activities that were encountered, quantitatively to explain the relationship of the intensity or duration of activities encountered. Percentages are calculated and described in the form of a histogram using tables and graphs. Calculation of the percentage of daily activities of Javan gibbons is done by counting the number of similar behaviors performed by each individual (X) in n hours compared to the number of behaviors observed in n hours in that individual (Y).

RESULTS AND DISCUSSION

Daily Activities of three juvenile of Javan gibbon begin in the morning between 06.00 - 07.00 and end in the afternoon starting at 16:30 - 17:00 (Table 2). The direct encountered with Amore, Kimkim and Salwa during the study was 580 minutes or 59 hours 40 minutes with a total encounter of 12 times. The encountered that followed from the beginning of the activity to the end of the activity is 6 times. The average daily activity time of Amore, Kimkim and Salwa is 9 hours 56 minutes. The active period of Javan gibbon in this study is similar with active period of Hylobatidae stated by Leighton (1986) referred to in Ario (2011), which is 8-10 hours every day.

The distribution of daily activities of Amore, Kimkim and Salwa shows variations based on the use of the average length of activity (Figure 3). We found out the percentage of feeding activity for juvenile of group S (Salwa) is about twice as Kimkim and Amore time budget. Activities and social activities are mostly carried out by Amore. The percentage of Amore's moving activity is 30.00% and social activity is 8.75%. The most resting activities carried out by Kimkim by 42.05%. Activity undetected to occur when individual Javan gibbon activities cannot be observed. This is due to juvenile Javan gibbons being covered by thick canopy so that observers cannot see the activities carried out by juvenile Javan gibbons.

Feeding activities

The Javan gibbon group whose sleep close to the feeding tree will eat at the beginning of its activity, while the Javan gibbon group whose sleep tree is far apart from the feed tree will move first and search for feed trees, then do the feeding activity. Juvenile Javan gibbons will follow females

Table 2. The time interval of beginning and end daily activities of three groups.

	Amore	Kimkim	Salwa
Early time activitiy	06.15 - 06.35	05.55 – 06.00	06.45 - 07.00
Frequency of initial time encounters	5	3	3
End time activity	16.00 – 16.30	16.30 – 17.00	16.30- 17.00
Frequency of end-time encounters	4	3	3
Total meeting time (minutes)	1 142	1 290	1 148

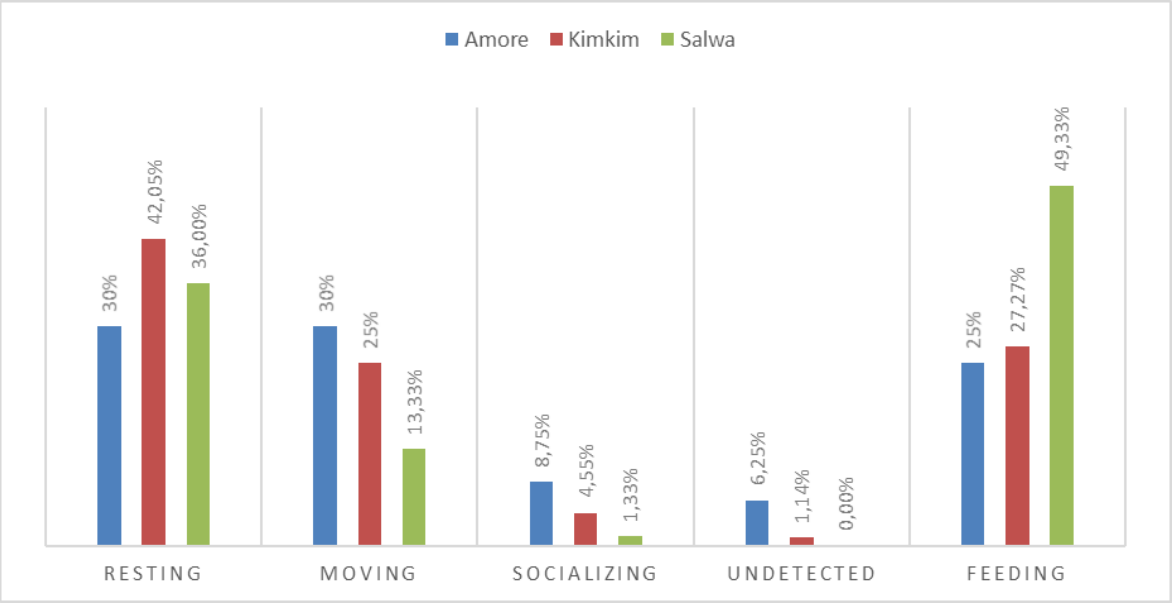


Figure 3. Comparison of the activities of Amore, Kimkim and Salwa.

and adult males in search of feed trees. However, juvenile Javan gibbons sometimes eat in different feed trees, but remain in close proximity to other group members. All Javan gibbons in the group are not always in the same feed tree.

Feeding activity of juvenile Javan gibbon is mostly done in the middle of the canopy. This is because there is more food in the middle canopy than in top canopy. The way juvenile javan gibbon eat is done in a sitting and hanging position (Figure 4). Juvenile will pull tree branches that have fruit and bring them closer to the body and take the fruit by hand or directly bite the feed from the tree branch. Small fruit will be eaten immediately, but for small-sized fruit the juvenile Javan gibbons will bite the fruit bit by bit.

The observations showed juvenile from group S (Salwa) had the highest percentage of feeding activity at 49.33% compared to Kimkim (27.27%) and Amore (25.00%) (Figure 3). Salwa has the highest feeding activity because the percentage of Salwa playing activities is highest compared to

Figure 4. Feeding activity of juvenile javan Gibbon.

Table 3. List of species of plants consumed by the juvenile javan gibbon from group A, B and S in Cikaniki-Citalahab.

No	Local Name	Scientific Name	Family	Habitus	Organs Consumed
1	Ficus Oren	*Ficus sinuata*	Moraceae	Tree	Ripe fruit
2	Kidage	*Bruinsmia styracoides*	Styracaceae	Tree	Ripe fruit
3	Kihaji	*Dysoxylum parasiticum*	Meliaceae	Tree	Young leaves
4	Kondang	*Ficus variegata*	Moraceae	Tree	Young leaves
5	Liana Bunga Ungu	*Poikilospermum suaveolens*	Urticaceae	Liana	Young leaves
6	Ficus Koneng	*Ficus sumatrana*	Moraceae	Liana	Ripe fruit
7	Polyalthia	*Polyalthia lateriflora*	Annonaceae	Tree	Young leaves
8	Kopi dengkung	*Nyssa javanica*	Nyssaceae	Tree	Unripe fruit
9	Kihuut	*Symplocos cochichinensis*	Symploceae	Tree	Ripe fruit
10	Liana Ficus Kisigung	*Ficus villosa*	Moraceae	Tree	Ripe fruit
11	Tokbray	*Blumeodendron tokbrai*	Caesalpiniaceae	Tree	Ripe fruit

Amore and Kimkim, so it requires more energy intake obtained from feeding. Feeding behavior is often a interlude from playing or moving behavior (Fleagle 1988). The high feeding activity of Salwa is also due to the fact that in the S group during our observation period, there are currently food trees that are bearing fruit, namely Ficus koneng (*Ficus sumatrana*) and kopi dengkung (*Nyssa javanica*) which begin to bear fruit in April-May, while the other groups didn't found eat in that feed tree. The availability of fruit trees that are bearing can have a very significant effect on home range, day range, and activity patterns for fruit-feeding arboreal primates (Clutton-Brock & Harvey 1977; Lambert 2007). The availability of food in the home range of each Javan gibbon group depends on the season of fruit availability in the feed tree and water (Iskandar 2007).

During the observation, there were 11 species that were used as food resource juvenile Javan gibbons found in Citalahab (Table 3) which were divided into 9 species of tree and 2 species of liana. Plant parts in the feed tree used are 7 species of ripe fruit, 1 species of unripe fruit and 4 species of young leaves. Rowe (1999) states that the percentage of Javan gibbon feed in nature is 61% fruit, 38% leaves, 1% flowers, insects, caterpillars, termites and honey.

The type of food most eaten is fruit compared to other types of food such as leaves and insects. This is because Javan gibbons are frugivorous primates. Fruits contain a lot of carbohydrates but lack of protein, so in addition Javan gibbons often eat young leaves or insects that contain lots of protein (Bismark 1991 in Prastyono 1999). Javan gibbons like ripe fruit, contain a lot of

sugar and watery, mostly are *Ficus* sp. (Leighton 1987). The percentage of feeding leaves is smaller than feeding fruit because *Hylobates* group has a monogastric digestive system, so it is unable to digest feed with high fiber content (Fleagle 1988).

Moving Activity

The observations showed that the individual who did the most mobile activity was Amore with a percentage of 30%, compared to Kimkim (25%) and Salwa (13.33%) (Figure 3). Amore has the highest percentage of moving, this is due to the overlap of group A's home range most extensive, so group A moves more to control the area and they try to defend it. Juvenile Javan gibbons will follow their parents in defending their home range. In accordance with the statement of Bismark (1984) which says that Hylobatidae moving activity in relation to the control of territory. Another factor that caused Amore to do more moving activities was high social activity compared to Kimkim and Salwa, so Amore moved more often to play with her siblings. Infant in the Amore group two years older compared with other groups, so Amore can play more often with infant, this is in accordance with the statement of Cheyne and Brule (2004) states that play activities in young Javan gibbon individuals can be done with other individuals who are at least 2 years older or younger.

The results of research conducted on Amore, Kimkim and Salwa found that the highest percentage is the movement of swinging (brachiation) (Figure 5). This is caused by the condition of canopy density in the forest area around Citalahab which has a large density so that it supports the adaptation of Javan gibbons in carrying out the type of movement of brachiation from one tree branch to another tree branch. This is in accordance with the statement of Arief (1998), swinging movements carried by Javan gibbons were almost 90% because the type of swinging movements was effectively carried out by Javan gibbons who had long shoulders and wrists.

Resting Activity

Resting activity is an inactive activity within a certain time interval or not doing any activity. The percentage of resting activity of

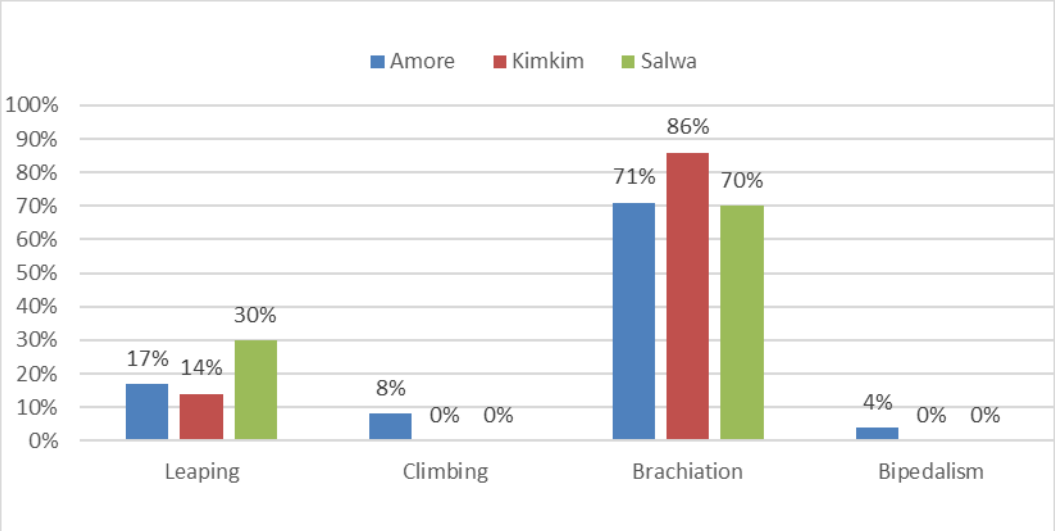


Figure 5. Types of juvenile javan gibbon movement.

Amore was 30%, Kimkim 42.05% and Salwa was 36% (Figure 3). According to Leighton (1987), Javan gibbon resting activities in nature are carried out between the time of their active period and the proportion of resting time around 20 - 51%. The resting activities of the Javan gibbon are carried out to compensate for play and moving activities (Prastyono 1999).

Kimkim's resting activity has the highest percentage. This is caused by the influence of weather and slightly cloudy temperatures at the time of observation making Kimkim tend to move with lower frequencies, while at the time of observation of Amore and Salwa the weather conditions are sunny so their not too much resting. In accordance with the statement of Iskandar (2007) that the rest period is usually done for several reasons, that is to provide an opportunity for physiological processes to digest the food consumed and unfavorable weather conditions, such as when the sun is hot during the day or when it rain.

High resting activity is also suspected Kimkim response due to the presence of observers in the form of immobile activity in place for some time (Figure 6). The response occurred because Javan gibbons were habituated by human presence. Nijman (2001) states that Javan gibbons change the escape response to a immobile response on the spot along with habitat change and increased human presence. According to Sutrisno (2001), resting activities are included in immobile activities and periods of inactivity with an indication that the gibbons do not carry out other activities for 10 minutes or more and resume other activities afterwards.

Figure 6. Sitting posture.

Long rest (sleep) will be done in a sleeping tree. Usually juvenile Javan gibbons will sleep in one tree with adult males in the position hugged by adult males, although sometimes juvenile do not sleep in one tree with adult males. Leighton (1987) stated that Javan gibbons can sleep in the same tree or separate trees up to a distance of 100 m.

During the observation, 6 trees were used as juvenile Javan gibbon sleeping trees (Table 4). The Javan gibbon sleeping tree is divided into 3 forms of canopy strata, namely strata A, B and C. According to the top canopy layer consists of trees with a total height of more than 30 m Suwandi (2000), the canopy layer can be classified into five strata:

1. Strata A: The top layer of the canopy consists of trees with a total height of more than 30 m, the canopy is discontinuous and tolerant.
2. Strata B: Consists of trees with a total height of between 20-30 m, continuous canopy and semitoleran.
3. Strata C: Consists of trees with a total height of between 4-20 m, continuous canopy, low and small diameter.
4. Strata D: Layer of shrubs and bushes with a height of 1-4 m.
5. Strata E: Under vegetation layer with a height of 0-1 m.

Table 4. Sleeping Tree of Juvenile Javan Gibbon in Cikaniki-Citalahab.

No	Species	Scientific Name	Height (m)	Diameter (cm)	Canopy Strata
1	Saninten	*Castanopsis argentea*	28.0	63.5	B
2	Rasamala	*Altingia excels*	38.6	102.0	A
3	Pasang	*Quercus sundaica*	32.1	97.3	A
4	Puspa	*Schima wallichi*	35.0	45.0	A
5	Rasamala	*Altingia excels*	49.5	107.0	A
6	Pasang	*Quercus sundaica*	35.0	93.6	A

There are 4 types of trees that are used as sleeping trees during the observation. The tree species are saninten, rasamala, pasang and puspa. Amore uses the saninten and rasamala trees as sleeping trees, Kimkim uses pasang and puspa trees, while Salwa uses the rasamala and pasang trees. The canopy layer classification above the Javan gibbon sleeping tree which is more widely used is the tree in strata A (more than 30 meters) as a sleeping tree with a height of 28 m - 49.5 m and a diameter of 45 cm - 107 cm. This is supported by the statement of Reichard (1998) that gibbons prefer sleeping trees with an average height of 32 m. The choice of a sleeping tree is an adaptation to minimize the risk of being detected and attacked by predators. Like other gibbons, *Hylobates moloch* is an arboreal species, living in the upper forest canopy, and sleeping and resting in the emergent part of the tree (Leighton 1987).

Social Activity

Social activities are activities related to the interaction between individual Javan gibbons in their groups and interactions between groups of Javan gibbons. Social activities include activities to vocalization, playing, grooming, copulation and agonostic with other Javan gibbon groups. In the individual Javan gibbon, social activities observed were playing, grooming and calling (Table 5).

In social activities, juvenile interact with all group members. The interaction of playing activities in the three groups was done

Table 5. Form and social activity of juvenile javan gibbon in Citalahab.

Subjek	Social Activity	Interaction	Frequency
Amore	Playing	Infant	52
		Adult Male	7
	Grooming	Adult Male	29
	Calling	Adult Female	2
Kimkim	Playing	Infant	32
		Adult Male	14
	Grooming	Adult Male	17
		Adult Female	1
	Calling	Adult Female	3
Salwa	Playing	Infant	29
		Sub Adult	25
		Adult Male	2
		Adult Female	1
		Adult Male	3
	Grooming	Adult Female	2
	Calling	-	0

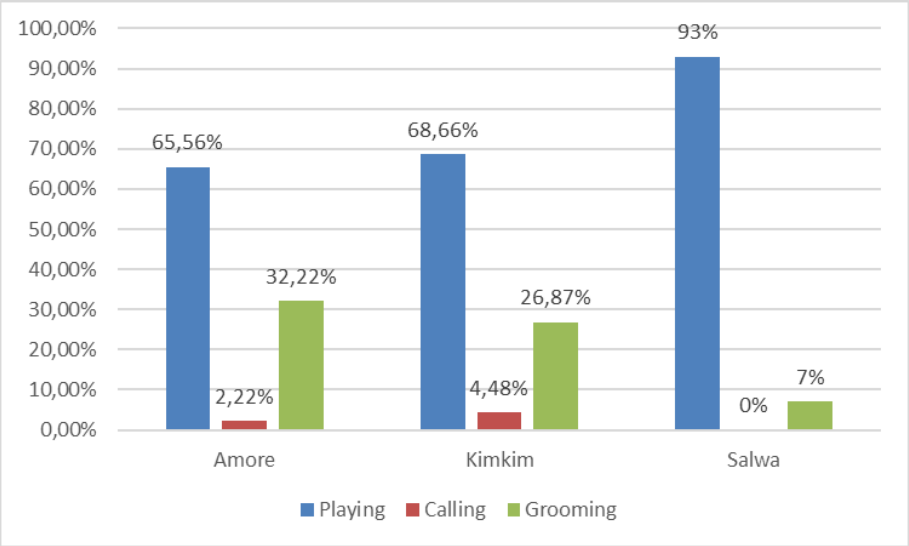


Figure 7. Percentage of social activitty juvenile javan gibbon.

with infants and adult males and the intensity of interaction was more often done with infants. In the calling activity interaction is only done by adult females and the activity of grooming is more often done with adult males. The differences in social activities of these three individuals will be displayed as a percentage (Figure 7)

The most social activities carried out by each individuals juvenile javan gibbon from all three groups are playing. Young individuals will spend a lot of their time and energi for playing (Bekoff 1972; Fagen & George 1977). The highest proportions of playing activities were Salwa (93.00%), Kimkim (68.66%) and Amore (65.56%). Salwa has the highest playing presentation. This is due to the presence of sub-adult Javan gibbons and one infant in one group, so playing activities are more often. Playing activities are learning efforts to improve movement and social communication skills. Playing activities are carried out by chasing, pulling and wrestling (Figure 8). Wrestling has highest percentage compared with chasing and pulling to play from each group, Amore (71.00%), Kimkim (80.00%) and Salwa (52.00%).

Grooming was the second highest activity performed by juvenile. Grooming

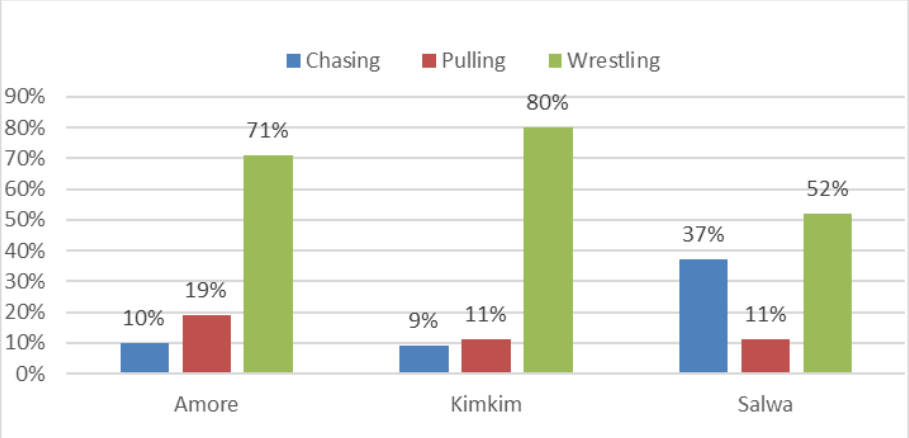


Figure 8. Percentage of playing movement juvenile javan gibbon.

behavior is the activity of cleaning up or caring for oneself also included in social communication between individuals of certain groups. For primates, grooming is a form of communication that is communication by touch (Napier and Napier 1985). The largest proportions of grooming activity were Amore (32.22%), Kimkim (26.87%) and Salwa (7.00%). Amore had the highest level of probing activity because during observation period, group A often rested during the day with a considerable amount of time and interspersed with grooming activity. Grooming activities are also carried out just before bedtime. Leighton (1987) stated that the activity of grooming is carried out at a certain time so as to form a pattern and increase at rest and after feeding, also found shortly before long sleep and Javan gibbons allocate 5% of their active time for grooming.

Grooming activity in juvenile Javan gibbons are carried out with adult male and adult females, but these activities are more often carried out by adult males. Juvenile individuals are more often received grooming although it is also seen that Javan gibbons probe adults in lower frequencies (Figure 9). This is in accordance with the statement of Nakamichi and Shizawa (2003), that adult monkeys are more likely to give grooming while children and babies are more likely to receiver.

Figure 9. Grooming activity.

Calling activity in Javan gibbon is a way of communicating to state the location of one group's existence to other groups at close distance so that it is related with efforts to avoid conflict or direct contact between groups. In addition, calling activity is a sign of ownership of an available food source. The voices issued by Javan gibbons are part of a number of social behaviors that are both agonistic (contradictory), ingestive (imitating), and care soliciting (asking for care).

In Javan gibbons, calling activity has a function in maintaining the group's home range by following the parent when calling. All the activities of the Javan gibbon are carried out with adult females. The type of call by juvenile and females is great call. This is consistent with the statement that based on observations of gibbons in captivity has revealed that young individual gibbons can accompany their mothers during the great call Geissmann (years unknown) referred to in Geissmann and Nijman (2006). When disturbed by the presence of other Javan gibbon groups, usually adult female individuals will make a call followed by young individuals. In Javan gibbons, adult females do more calling activity than adult males, this is related to the role of females as dominant individuals in the Javan gibbon group and children do the behavior of imitating female individuals to engage in calling activities.

The proportion of the calling activity by young Javan gibbons in Citalahab were Kimkim (4.48%), Amore (2.22%) and Salwa (0.00%). Amore had a smaller calling percentage compared to Kimkim, while in Salwa no calling activity was recorded during

Table 6. Average Daily Activity of Juvenile Javan Gibbon.

Activity	Amore	Kimkim	Salwa	Total	Average (%)
Feeding	20	24	37	81	33.33
Moving	24	22	10	56	23.05
Resting	24	37	27	88	36.21
Socializing	7	4	1	12	4.94
Undetected	5	1	0	6	2.47
Total				243	100

the observation. Kimkim has the highest percentage because during the observation there was a conflict with another unhabituated group, namely group O while in Salwa there was no calling activity during the observation. It may happened because home range of group S is adjacent with main road and tea plantation, this makes so many distraction such as the noise from workers in the tea plantation and the sound of motorbikes. In accordance with the statement of Chivers (1980) in Oktaviani (2009) which states that the existence of interference of external factors will have an impact on the intensity of the calling behavior of Javan gibbon that will be increasingly rare.

Average Daily Activity

The results of observing the daily activities of juvenile Javan gibbons in Citalahab obtained the average percentage of daily activity (Table 6) from the highest to the lowest are resting (36.21%), feeding (33.33%), moving (23.05%) %), socializing (4.94%) and undetected (2.47%).

Resting has the highest percentage among other activities. Juvenile Javan gibbon activity from the three groups has a percentage of 36.21% which is the largest percentage of all the main daily activities carried out by Javan gibbon. Resting on the Javan gibbons are done to compensate for the high proportion of moving and playing activities. In accordance with the statement of Ladjar (1996) in Sutrisno (2001) that resting activities including sitting are carried out for the purpose of recovering the energy that is used to perform various activities that emit a lot of energy. Breaking activities are carried out among other activities such as feeding, moving or social activities.

Feeding activity is the second largest activity. Sutrisno (2001) and Prastyono (1999) stated that juvenile need a lot of nutrition for body growth and development. Moving activity is the third largest activity, this is because juvenile who often move to explore the surrounding area, looking for food, knowing the range and doing social activities such as playing. Undetected occur when the individual activities of juvenile Javan gibbons cannot be observed because they are covered by a tight canopy, so observers cannot see the activities carried out by juvenile Javan gibbons.

CONCLUSION

There is no indication of behavior change in juvenile Javan gibbons in Citalahab at Halimun Salak National Park, West Jawa. Percentage of daily activity from the highest to the lowest is the resting

(36.21%), feeding (33.33%), moving (23.05%), socializing (4.94%) and undetected (2.47%).

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